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Exploratory behavior in the hooded and albino rats as a function of apparatus complexity and food deprivation

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EXPLORATORY BEHAVIOR IN THE HOODED AND ALBINO RATS AS A FUNCTION OF APPARATUS COMPLEXITY AND FOOD DEPRIVATION

by

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INTRODUCTION

The classical view that food-deprived animals exhibit more general activity than satiated animals (Munn, 1950; Reed, 1947; Shirley, 1929) is currently being subjected to closer scrutiny. A review of the literature concerned with exploratory behavior (activity) in the laboratory rat as a function of food deprivation, reveals conflicting results about the exploratory behavior (activity) of food deprived as opposed to satiated animals.

Bolles (1959), Campbell & Sheffield (1953), Wechkin (1959) and Welker (1959) report no differences between food-deprived and satiated Ss in the amount of exploraton (activity) recorded. Greater exploration (activity) of satiated Ss is reported by Bruce (1938), Cotton (1953), Elliott (1934), Montgomery (1953), Treichler and Hall (1962), and Zimbardo and Montgomery (1957). Others report more exploratory behavior (activity) by deprived Ss (Alderstein & Fehrer, 1955; Bolles & de Lorge, 1962; Fehrer, 1956; Finger, 1951; Glickman & Jensen, 1961; Hall, Smith, Schnitzer, & Hanford, 1953; Hall, 1956; Moskowitz, 1959; Petrinovich & Bolles, 1954; Siegel & Steinberg, 1949; Strong, 1957; Thompson, 1953).

One hypothesis suggesting a reason for the conflicting results is that the relationship between food deprivation and exploratory

behavior (activity) does not remain constant in all situations, but varies under different environmental conditions. Montgomery (1953) suggests that a deprived animal may exhibit less exploratory behavior than a satiated animal in a simple situation, such as a T-maze or a Y-maze, but that in a more complex situation the deprived animal will exhibit more exploratory behavior than its satiated counterpart. Cotton (1953) suggests that a deprived S apparently runs faster in a runway situation because it engages in less exploration than the satiated animal. Estes (1958) interprets this data as indicating the environmental cues have less "weight" than the internal cues of deprivation and, therefore, are not effective in modifying the animal's behavior. Montgomery (1951) states that the exploratory behavior exhibited is a function of the opportunity for exploration provided to the animal. Bolles & de Lorge (1962) state "...the occurrence of (exploratory behavior) depends primarily upon the nature of the environmental stimulation and only secondarily and to a minor extent upon the animal's deprivation condition." Also "...the size of the deprivation effect seems to depend upon the level of exploration that occurs in the testing sitation."

When experiments considering exploration (activity) as a function of food deprivation are analyzed in terms of environmental conditions, it is noted that in some instances consistant results are obtained with a particular device. For example, Finger (1951), Hall (1956), Hall, Smith, Schnitzer, & Hanford (1956), Moskowitz (1959), and Strong (1957), report greater activity on the part of food-deprived Ss in the activity wheel. Greater exploration by food-deprived Ss is reported by Petrinovich & Bolles (1954) and Thompson (1953) when elevated mazes are used.

Conflicting results are also reported when similar apparatuses are used. Deprived Ss are reported to explore more when large boxes (without obstructions) are used (Bolles & de Lorge, 1962; Fehrer, 1956; Siegel & Steinberg, 1949). Bolles (1959) and Welker (1959) report no differences between the exploratory behavior exhibited by deprived and satiated Ss when large boxes are used. Utilizing runways, Wechkin (1959) reports no differences between exploration (activity) levels of food-deprived and satiated Ss, while Cotton (1953) and Elliott (1934) report greater exploration (activity) on the part of satiated Ss. Campbell & Sheffield (1953) report no differences in levels of exploration (activity) of deprived and satiated Ss when stabilmeter cages are used, whereas Treichler & Hall (1962) report more exploration (activity) on the part of satiated Ss. Montgomery (1953) using an enclosed Y-maze, reports that the satiated Ss explore more, while Glickman & Jensen (1961) report the deprived Ss explore more.

The present study was an attempt to determine the effect of apparatus design on exploratory behavior in male albino and hooded rats. The specific hypothesis was that exploration would increase as a function of environmental complexity. The study might also yield information concerning the relationship between food deprivation and exploration.

In keeping with the majority of previous studies concerned with exploration, the present investigation defines exploration in

terms of locomotion, i.e., the number of 3 in. x 6 in. sections of the apparatus entered or traversed by the S per unit time. Complexity will be defined in terms of the number of 3 in. x 6 in. x 7 in. cubicles available for entrance by S.

Method

Subjects. Forty-eight male rats, 24 hooded and 24 albino, 60 to 90 days old at the start of the study were used. Each group was subdivided into three groups of eight Ss each as follows: Group S (satiated), Group 90% (reduced to 90% of initial weight) and Group 18 (18 to 22 hours food deprived). Each of these groups was then divided, and one-half the Ss run as a replication experiment. All Ss used in the replication experiment were 90-days old, those in the original experiment 60-days old.

Apparatus. An openfield, 21 in. x 36 in. x 7 in. constructed of ¼-inch plywood, with a hardware cloth hinged cover was used (Fig. 1, Appendix A). The complexity of this openfield was varied by inserting movable 3 in. x 6 in. x 7 in. cubicles containing a 1-inch slit at the bottom of one side which served as an entrance. All entrances faced the same direction. The entire apparatus was painted blue. In order to record the movements of the Ss, the floor was marked off into 3 in. x 6 in. sections.

The first level of complexity (1) consisted of one cubicle centered in each half of the openfield.

Complexity level 2 consisted of two cubicles placed in a row, 3 inches apart, their 3-inch sides parallel to the 18-inch sides of the openfield. The first cubicle in each half of the openfield was 6 inches from the midline.

Complexity level 3 consisted of four cubicles placed so that the first column in each half of the openfield was 6 inches from the midline. All other alleys formed by placement of the cubicles were 3 inches wide.

Covered, stainless steel cages, 28 in. x 10 in. x 9 in. and hardware cloth laboratory cages were used as living and feeding cages respectively.

Procedure. The same general procedure was used for all Ss.

The Ss were never fed in the stainless steel living cages. Water was available in the living cages at all times.

The Ss were weighed on alternate days, following the day's trial.

Deprived Ss were fed and watered for one hour, 90 minutes after the completion of the day's trial.

In order to control odor cues, the openfield was wiped with a damp sponge after each trial.

The feeding procedure was as follows. The Ss in Group 90% and Group 18 were taken from the living cages and placed in a large cardboard box for 15 minutes. They were then placed in the hardware cloth cages and permitted to eat and drink for one hour. After feeding, the Ss were again placed in the large cardboard box for 15 minutes and returned to the living cages. The Ss in Group S were treated in the same manner as the deprived animals with the exception of placement in the feeding cages for 90 minutes prior to each day's trial.

All Ss were given one 6-minute trial daily in the apparatus for 21 days. Experience with one level of complexity constituted one day's trial. The order in which any one S experienced the various levels of complexity was arranged so that each level was experienced once within any three-day period. All Ss began each trial in a constant predetermined part of the apparatus. At the end of the 6-minute period, the S was removed from the apparatus and returned to the living cage.

The responses of each S were recorded with a tape recorder and transcribed at a later time.

The following response measures were continuously recorded during three, 2-minute intervals: (a) the number of units, floor sections of the openfield, traversed or entered with the forefeet (b) the number of times the nose was poked into a cubicle up to the ears and withdrawn (partial entry).

Results

No significant differences in amount of exploration were obtained in experiment I or in the replication experiment in terms of apparatus complexity. This was true both in the case of number of sections entered or traversed and in the case of total number of partial entries (Friedman's Two-way Analysis of Variance by Ranks, Siegel, 1956, Table 1, Appendix A).

In some instances significant differences were found between responses made under different levels of food deprivation. Analysis of the number of sections of the openfield entered or traversed (Table 2, Appendix A) indicates that at complexity levels 1, 2 and

3, hooded Ss, Group 90%, entered significantly more sections of the openfield than satiated Ss. An identical result was obtained at complexity levels 1 and 2, when the scores of experiment I and the replication experiment were combined ($p \leq .05$, Mann-Whitney U Test, Siegel, 1956).

Analysis of the number of sections of the openfield entered or traversed by albino Ss, Group 18, at complexity level 1 in experiment I and the replication experiment, indicates that these animals explored to a significantly greater degree than did the rats in Group S ($p < .05$, Mann-Whitney U Test, Siegel, 1956). When combined scores were analyzed, this was also true at complexity levels 1 and 2 ($p < .05$, Mann-Whitney U Test, Siegel, 1956). It was found in the replication experiment, that Group 90% (albino) explored significantly more than Group S at complexity levels 1 and 2 ($p < .05$, Mann-Whitney U Test, Siegel, 1956).

Analysis of the partial entries (Table 3, Appendix A) indicates that Group 18 (albino) explored significantly more than Group 90% at complexity levels 1 and 2 in experiment I. When the combined scores were analyzed, this relationship was also found at complexity level 2 ($p < .05$, Mann-Whitney U Test, Siegel, 1956). A significantly greater amount of exploration occured among Group 18 Ss than Group S Ss at complexity level 1, in experiment I and at complexity level 2, in the replication experiment ($p < .05$, Mann-Whitney U Test, Siegel, 1956). This relationship held at complexity level 1 and 2 when the combined scores were analyzed ($p < .05$, Mann-Whitney U Test, Siegel, 1956).

No significant differences were obtained when the scores of the hooded rats were compared with those of the albino rats (Mann-Whitney U Test, Siegel, 1966).

The median values of number of sections of the openfield entered or traversed, by S, and also the median values of number of sections of the openfield entered or traversed by groups are reported in Appendix B. The total number of partial entries, by S, and the median value of partial entries by groups are also reported in Appendix B.

Discussion

The results of the present study do not support the hypothesis that exploration increases with increased complexity of the environmental situation. This finding is contrary to the speculations that exploration will increase as a function of environmental complexity (Glanzer, 1961; Montgomery, 1953; Thompson, 1953; Wechkin, 1959). This speculation is made in view of the inconsistent results reported about the effects of food deprivation on exploratory behavior. The judgment, however, that one apparatus is more complex than another is generally not based upon systematic differences in the design of the apparatus, consequently, a design considered to be complex by one author, may not be judged complex by another.

The number of cubicles was the criterion for complexity used in the present study. Using this criterion of complexity, it was found that Ss did not respond differentially insofar as the total number of sections entered or traversed, or the total number of partial entries was concerned.

One hypothesis accounting for the results obtained in this study is that regardless of the complexity of the environment, similar behavior will be exhibited as long as the state of the organism remains constant.

Another possibility is that the device used in the present study does not have the characteristics needed to reflect increases in exploration. For example, the size of the floor sections may be too small to reflect accurately different levels of exploration.

The total number of partial entries (nose pokes) is similar to the "window peeking" response used by de Lorge and Bolles (1961). Berlyne (1960) and de Lorge and Bolles (1961) suggest that response measures such as "window peeking," sniffing, manipulation of an object and similar responses are more appropriate measures of exploration. However, the present results indicate the measure of "nose poking" does not differentiate among levels of complexity any better than does the total number of floor sections entered.

The criterion for complexity in the present study was chosen because it coincided most closely with those particular aspects of the apparatuses used which were compared in the literature as being complex and less complex. The major criterion for complexity apparently is the number of walls or obstructions encountered by the Ss. However, this may not be the primary factor influencing the animal's behavior. The studies concerned with lights, differential texture of apparatus, and clicks or bells as reinforcers, suggest that perhaps the complexity of a situation might be more effectively

varied along one of these dimensions (Barnes & Baron, 1961; Barnes & Kish, 1957; Barnes & Kish, 1958; Clayton, 1958; Levin & Forgays, 1959; Lockard, 1961; Morris, Crowder, & Crowder, 1961; Robinson, 1959; Stewart, 1960). The use of small objects within the apparatus is also a possibility, but the previous experience of the S with such objects or similar objects, is difficult to control.

With few exceptions, the results of the present study are in accord with some of the current literature concerned with exploration or activity as a function of food deprivation. One exception is the finding that 18-hour food-deprived Ss explore more than Ss reduced to 90% of their initial body weight. Such a relationship has not been reported previously.

Results of the present study do not answer the questions posed by the current literature, nor resolve any of the inconsistancies noted.

It was found that the number of partial entries differentiates between Ss reduced to 90% of their initial body weight and 18-hour food-deprived Ss, whereas the measure of total number of units entered does not. This result raises the question as to whether different response measures must necessarily correlate. The question as to which measures of exploration, if any, correlate, and which of the possible measures is the best indicator of exploration still remains an empirical one.

It would be expected that an animal's behavior would reflect the conditions produced in its body through deprivation procedures. Also, it appears reasonable that an animal's behavior would reflect

the effects of large quantities of stimuli, or varied or intense stimuli. The question to be answered is, what behavior changes are produced by experimental manipulation rather than do experimental manipulations produce a change in behavior.

Summary

The present study investigated the possible relationships existing among exploration, environmental complexity and levels of food deprivation in the albino and hooded rats. Two measures of exploration were analyzed: (a) total number of floor sections of an openfield entered or traversed and (b) total number of partial entries into cubicles. The major hypothesis that the level of exploration will increase with increased complexity of environmental situation was not supported.

The two measures revealed approximately similar relationships between levels of food deprivation, with the exception that the total number of floor sections entered or traversed did not differentiate between the 18-hour food-deprived group and the group reduced to 90% of initial body weight, as did the total number of partial entries. On the other hand, the total number of partial entries did not differentiate between the group reduced to 90% of initial body weight and the satiated group as did the total number of sections entered or traversed. The problem of defining complexity as well as that of determining which response measure is most appropriate as an indicator of exploratory behavior was discussed.

References

Alderstein, Arthur & Fehrer, E. Effect of food deprivation on exploratory behavior in a complex maze. J. comp. physiol. Psychol., 1955, 48, 250-253.

Barnes, G. W. & Baron, A. Stimulus complexity and sensory reinforcement. J. comp. physiol. Psychol., 1961, 54, 466-469.

Barnes, G. W. & Kish, G. B. Reinforcing properties of intense auditory stimulation. J. comp. physiol. Psychol., 1957, 50, 40-43.

Barnes, G. W. & Kish, G. B. On some properties of visual reinforcement. Amer. Psychologist, 1958, 13, 417.

Berlyne, D. E. Conflict, arousal, and curiosity. New York: McGraw Hill, 1960.

Bolles, Robert C. Group and individual performance as a function of intensity and kind of deprivation. J. comp. physiol. Psychol., 1959, 52, 579-585.

Bolles, R. C. and de Lorge, J. The effect of hunger on exploration in a familiar locale. Psychol. Rep., 1962, 10, 54.

Bruce, R. H. The effect of lessening the drive upon performance by white rats in a maze. J. comp. Psychol., 1938, 25, 225-248.

Campbell, Byron A. & Sheffield, F. D. Relation of random activity to food deprivation. J. comp. physiol. Psychol., 1953, 46, 320-322.

Clayton, Frances L. Light reinforcement as a function of water deprivation. Psychol. Rep., 1958, 4, 63.

Cotton, J. W. Running time as a function of food deprivation. J. exp. Psychol., 1953, 46, 188-199.

Elliott, M. H. The effect of hunger on variability of performance. Amer. J. Psychol., 1934, 46, 107-112.

Estes, W. K. Stimulus-response theory of drive. In Marshall R. Jones (Ed.), Nebraska symposium on motivation, Lincoln: University of Nebraska Press, 1958.

Fehrer, Elizabeth. Effects of hunger and familiarity of locale on exploration. J. comp. physiol. Psychol., 1956, 49, 549-552.

Finger, F. W. Effect of food deprivation and subsequent satiation upon general activity in the rat. J. comp. physiol. Psychol., 1951, 44, 557-564.

Glanzer, Murray. Changes and interrelations in exploratory behavior. J. comp. physiol. Psychol., 1961, 54, 433-438.

Glickman, Stephen E. & Jensen, Glen D. The effects of hunger and thirst on Y-maze exploration. J. comp. physiol. Psychol., 1961, 54, 83-85.

Hall, John F. Relationship between external stimulation, food deprivation and activity. J. comp. physiol. Psychol., 1956, 49, 339-341.

Hall, J. F., Smith, I., Schnitzer, Samuel B. & Hanford, Peter V. Elevation of activity level in the rat following transition from ad lib to restricted feeding. J. comp. physiol. Psychol., 1953, 46, 429-433.

Levin, H. & Forgays, D. G. Learning as a function of sensory stimulation of various intensities. J. comp. physiol. Psychol., 1959, 52, 195-201.

Lockard, Robert B. Self-regulation of luminance by albino rats. Psychol. Rep., 1961, 9, 345.

Montgomery, K. C. The relation between exploratory behavior and spontaneous alternation in the white rat. J. comp. physiol. Psychol., 1951, 44, 582-589.

Montgomery, Kay C. Effect of hunger and thirst drive upon exploratory behavior. J. comp. physiol. Psychol., 1953, 46, 315-319.

Morris, John B., Crowder, W. & Crowder, Thora. Stimulus variation and weak light reinforcement. Psychol. Rep., 1961, 8, 290.

Moskowitz, M. J. Running wheel activity in the white rat as a function of combined food and water deprivation. J. comp. physiol. Psychol., 1959, 52, 621-625.

Munn, N. L. Handbook of psychological research on the rat. Boston: Houghton Mifflin, 1950.

Petrinovich, Lewis & Bolles, Robert. Deprivation states and behavioral attributes. J. comp. physiol. Psychol., 1954, 47, 450-53.

Reed, J. D. Spontaneous activity of animals. Psychol. Bull., 1947, 44, 393-412.

Robinson, J. S. Light onset and termination as reinforcers for rats living under normal light conditions. Psychol. Rep., 1959, 5, 793-796.

Shirley, M. Spontaneous activity. Psychol. Bull., 1929, 26, 341-365.

Siegel, P. S. & Steinberg, M. Activity levels as a function of hunger. J. comp. physiol. Psychol., 1949, 42, 413-416.

Siegel, Sidney. Nonparametric Statistics. New York: McGraw Hill, 1956.

Stewart, J. Reinforcing effects of light as a function of intensity and reinforcement schedule. J. comp. physiol. Psychol., 1960, 53, 187-193.

Strong, Paschal, N., Jr. Activity in the white rat as a function of apparatus and hunger. J. comp. physiol. Psychol., 1957, 50, 596-599.

Thompson, W. Exploratory behavior as a function of hunger in "bright" and "dull" rats. J. comp. physiol. Psychol., 1953, 46, 323-326.

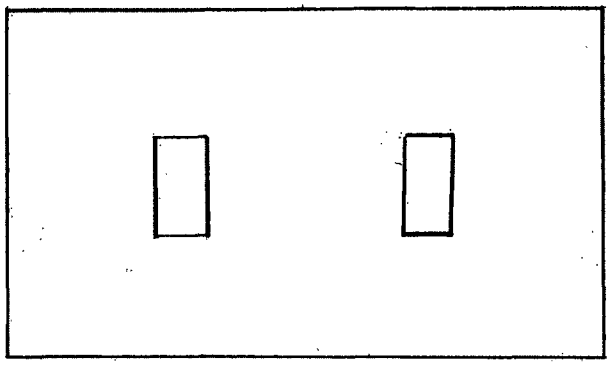
Treichler, F. Robert & Hall, J. F. The relationship between deprivation, weight loss and several measures of activity. J. comp. physiol. Psychol., 1962, 55, 346-349.

Wechkin, Stanley. The effect of stabilized and nonstabilized hunger drive, age, and situation complexity upon exploratory behavior. Disstr. Abstracts, 1959, 20, 1457.

Welker, W. I. Escape, exploratory and food seeking responses of rats in a novel situation. J. comp. physiol. Psychol., 1959, 52, 106-111.

Zimbardo, Philip G. & Montgomery, K. C. Relative strengths of consummatory responses in hunger, thirst and exploratory drive. J. comp. physiol. Psychol., 1957, 50, 504-508.

APPENDIX A



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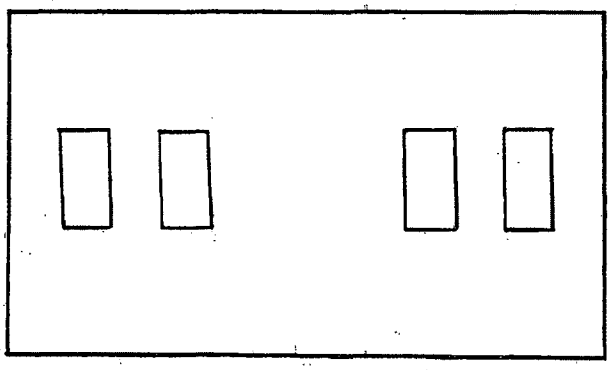

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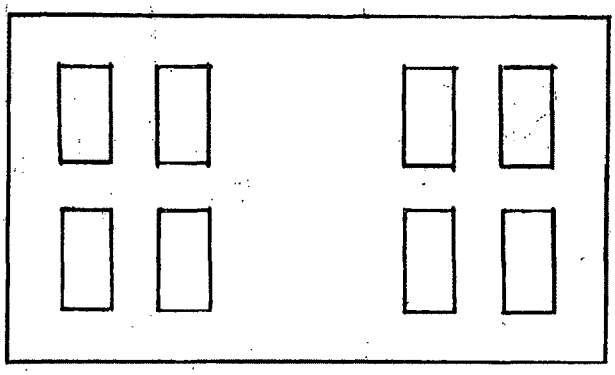

(3)

Fig. 1. Floor plan of apparatus

Table 1

Friedman's two-way analysis of variance by ranks of the median values of sections entered or traversed and median values of partial entries for levels of deprivation by levels of complexity

(K=3; N=3)

	Sections entered	Partial entries
Experiment I		
Albino	.6	4.6
Hooded	2.6	4.9
Replication		
Albino	2.3	4.6
Hooded	4.6	.6

Table 2

Mann-Whitney U values obtained between levels of deprivation at three levels of apparatus complexity for the number of floor sections entered or traversed

(N=4 in Experiment I and Replication; N=8 in Combined)

	Albino			Hooded		
	Exp. I	Rep.	Combined	Exp. I	Rep.	Combined
Apparatus Complexity 1						
90% vs. 18 hr.	4	5	26	6	8	30
18 hr. vs. Sat.	0*	0*	6*	4	6	—**
Sat. vs. 90%	6	1*	19	0*	6	—**
Apparatus Complexity 2						
90% vs. 18 hr.	5	4	31	5	7	21
18 hr. vs. Sat.	4	3	15*	8	8	27
Sat. vs. 90%	8	2*	20	0*	6	12*
Apparatus Complexity 3						
90% vs. 18 hr.	4	7	26	8	6	29
18 hr. vs. Sat.	5	4	19	4	7	—**
Sat. vs. 90%	7	8	23	0*	7	—**

* $p < .05$

** Scores were not combined in view of the fact that significant differences were obtained between Experiment I and the Replication.

Table 3

Mann-Whitney U values obtained between levels of deprivation at three levels of apparatus complexity for the number of partial entries (N=4 in Experiment I and Replication; N=8 in Combined)

	Albino			Hooded		
Apparatus Complexity 1						
	Exp. I	Rep.	Combined	Exp. I	Rep.	Combined
90% vs. 18 hr.	1*	6	—**	5	5	32
18 hr. vs. Sat.	1*	7	15*	8	7	29
Sat. vs. 90%	7	7	—**	8	5	31
Apparatus Complexity 2						
	Exp. I	Rep.	Combined	Exp. I	Rep.	Combined
90% vs. 18 hr.	2*	3	11*	7	7	31
18 hr. vs. Sat.	5	1*	11*	5	6	23
Sat. vs. 90%	7	3	25	7	6	29
Apparatus Complexity 3						
	Exp. I	Rep.	Combined	Exp. I	Rep.	Combined
90% vs. 18 hr.	4	4	18	6	5	—**
18 hr. vs. Sat.	8	6	23	6	4	18
Sat. vs. 90%	5	6	30	7	4	—**

* $p < .05$

** Scores were not combined in view of the fact that significant differences were obtained between Experiment I and the Replication.

APPENDIX B

Table 1

Median value of floor sections entered or traversed by groups

Experiment I

	Albino			Hooded		
	Complexity level			Complexity level		
	1	2	3	1	2	3
90%	82.0	90.5	121.0	217.5	224.0	171.5
18 hr.	178.0	174.5	152.0	210.5	188.5	183.0
Sat.	82.0	133.0	104.5	100.5	160.5	101.2

Replication

	Albino			Hooded		
	Complexity level			Complexity level		
	1	2	3	1	2	3
90%	181.0	206.5	140.0	211.5	207.0	179.0
18 hr.	168.5	149.0	135.5	207.5	158.5	175.0
Sat.	127.5	63.0	107.5	183.0	178.0	158.5

Table 2

Median value of floor sections entered or traversed for each S at three levels of complexity - Experiment I

	90% - Albino				90% - Hooded		
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	266	264	180	1	228	248	162
2	110	128	114	2	193	200	181
3	75	53	128	3	207	181	153
4	47	52	74	4	408	421	270
	18 hr. - Albino				18 hr. - Hooded		
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	159	144	125	1	202	173	180
2	197	222	174	2	231	294	197
3	241	205	193	3	70	79	89
4	156	105	130	4	219	204	186
	Sat. - Albino				Sat. - Hooded		
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	139	142	183	1	105	128	105
2	99	124	70	2	95	166	94
3	21	39	60	3	128	155	153
4	65	201	139	4	96	167	97

Table 3

Median value of floor sections entered or traversed for each S at three levels of complexity - Replication experiment

90% - Albino				90% - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	189	240	152	1	230	237	186
2	173	173	128	2	138	143	78
3	219	246	197	3	214	209	184
4	135	118	112	4	209	205	174
18 hr. - Albino				18 hr. - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	169	165	149	1	230	155	206
2	174	211	155	2	185	162	144
3	168	103	122	3	155	146	114
4	165	133	117	4	261	315	233
Sat. - Albino				Sat. - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	133	52	130	1	179	158	142
2	112	76	85	2	258	247	198
3	191	201	146	3	134	123	154
4	16	27	5	4	187	198	163

Table 4

Median values of partial entries by groups

Experiment I

	Albino			Hooded		
	Complexity level			Complexity level		
	1	2	3	1	2	3
90%	4.5	6.0	11.5	12.5	13.5	14.5
18 hr.	24.0	17.5	22.0	10.0	10.5	14.0
Sat.	2.5	8.0	16.0	12.5	14.5	14.5

Replication

	Albino			Hooded		
	Complexity level			Complexity level		
	1	2	3	1	2	3
90%	13.5	9.0	16.0	9.0	10.0	7.0
18 hr.	15.5	16.0	22.0	11.0	9.0	11.5
Sat.	12.5	2.5	16.5	14.0	15.5	22.0

Table 5

Total number of partial entries for each S at three levels of complexity

Experiment I

90% - Albino				90% - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	9	14	10	1	8	6	14
2	6	10	19	2	17	19	29
3	1	0	13	3	5	8	15
4	3	2	6	4	32	31	14
18 hr. - Albino				18 hr. - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	47	23	27	1	16	13	9
2	18	17	17	2	4	8	13
3	30	18	29	3	2	2	15
4	6	6	6	4	21	21	16
Sat. - Albino				Sat. - Hooded			
	Complexity Level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	12	20	34	1	10	16	8
2	5	9	14	2	15	13	16
3	3	2	8	3	39	28	58
4	4	7	18	4	1	4	13

Table 6

Total number of partial entries for each S at three levels of complexity

Replication Experiment

90% - Albino				90% - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	4	7	11	1	4	7	2
2	16	11	30	2	14	18	13
3	20	17	21	3	20	13	12
4	11	5	9	4	1	2	2
18 hr. - Albino				18 hr. - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	19	19	21	1	4	2	8
2	28	30	30	2	7	10	12
3	10	8	11	3	15	8	15
4	12	13	23	4	23	24	11
Sat. - Albino				Sat. - Hooded			
	Complexity level				Complexity level		
Ss	1	2	3	Ss	1	2	3
1	10	4	26	1	13	29	26
2	15	0	8	2	15	11	18
3	33	12	25	3	4	1	2
4	0	1	4	4	18	20	29